Spirometry: a key measurement in diagnosing and treating asthma

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Conflict of Interests Disclosures

- I am on the Speakers Bureau for Hill Rom and Pharmaxis
- I am a trainer for Hill Rom and Pharmaxis

- I have no conflict of interests with this presentation

Objectives

- Demonstrate spirometry and how spirometry is interpreted
- Explain the pre-post test preparation and equipment/supplies needed for various tests
- Review the testing procedures and define a positive tests

Why perform spirometry?

- Add to diagnosis of disease (pulmonary and cardiac)
- Assess response to new medications
- Can help monitor progression of disease and effectiveness of treatment
- Aid in pre-operative assessment of certain patients
- Worker's compensation claims
- Research

Spirometry is valuable but….

- It does not stand alone
  - It acts only to support or exclude a diagnosis.
- History and physical exam, laboratory data, imaging will help establish a diagnosis.

Importance of objective measurement

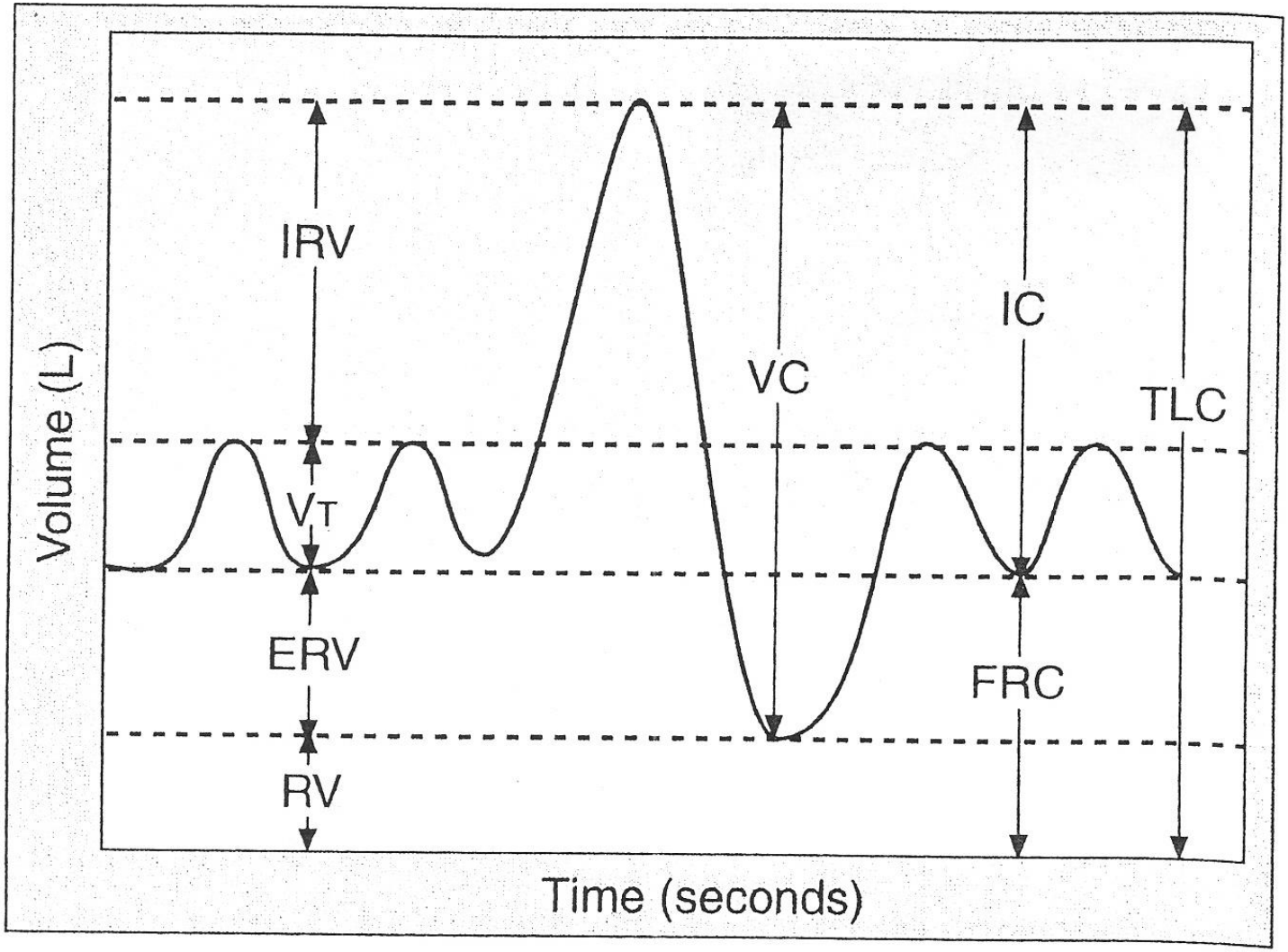
- Patients and physicians often have inaccurate perceptions of severity of airflow obstruction
  - Asthma patients may be “poor perceivers”….
- Spirometry provides objective evidence in identifying patterns of disease

Undiagnosed patients?

Suspicion of lung disease?

- Four classic symptoms:
  - Wheezing
  - Chest tightness
  - SOB/DOE
  - Coughing
    - Asthma – all 4 often present
    - COPD - excludes chest tightness

SPIROMETRY

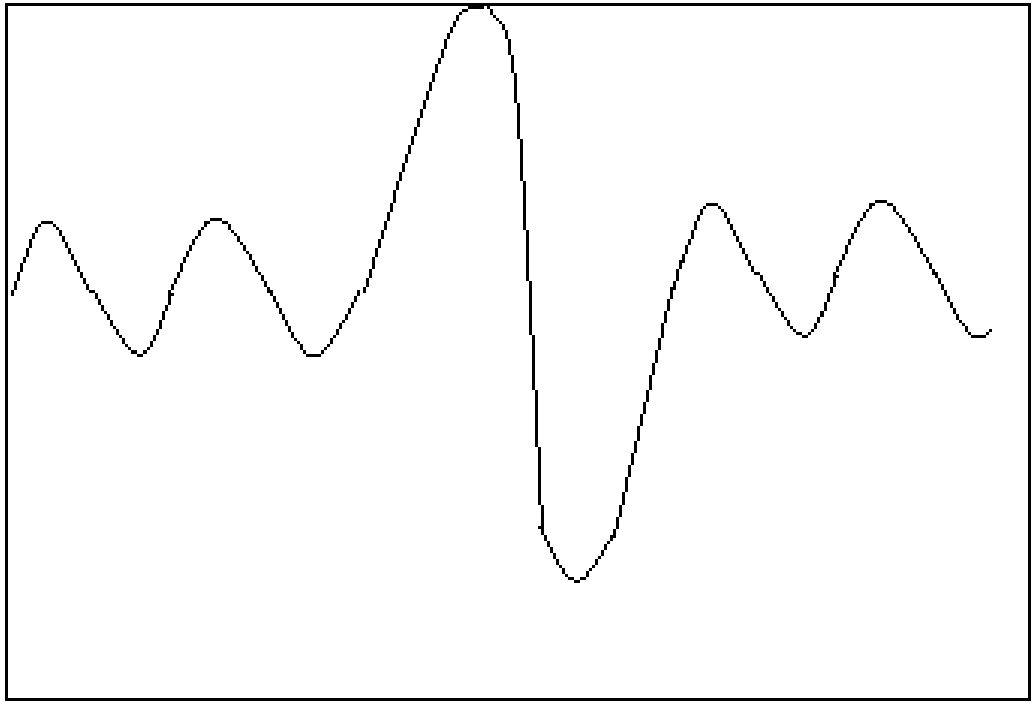


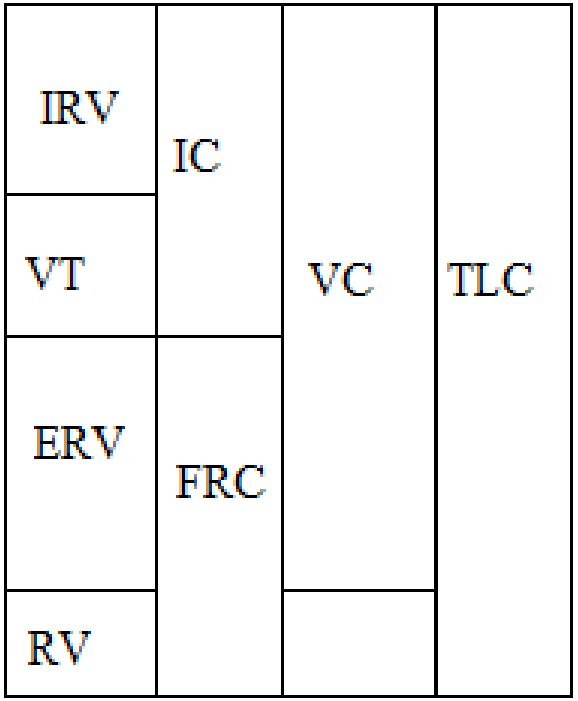
Frequency –how of often to do spirometry

- Measure lung function by spirometry when:
  1. Performing the initial assessment
  2. After treatment has started and symptoms are stabilized – look for airways to be “near normal”
  3. Anytime there is a progression downward or a prolonged loss of asthma control
  4. At least every 1-2 years to assess control

  5. Follow for life

4 volumes – 4 capacities





* Capacities are made up of 2 or more volumes
* 3 of these 8 items cannot be measured by spirometry (RV, FRC, TLC)

Overview -Spirometry

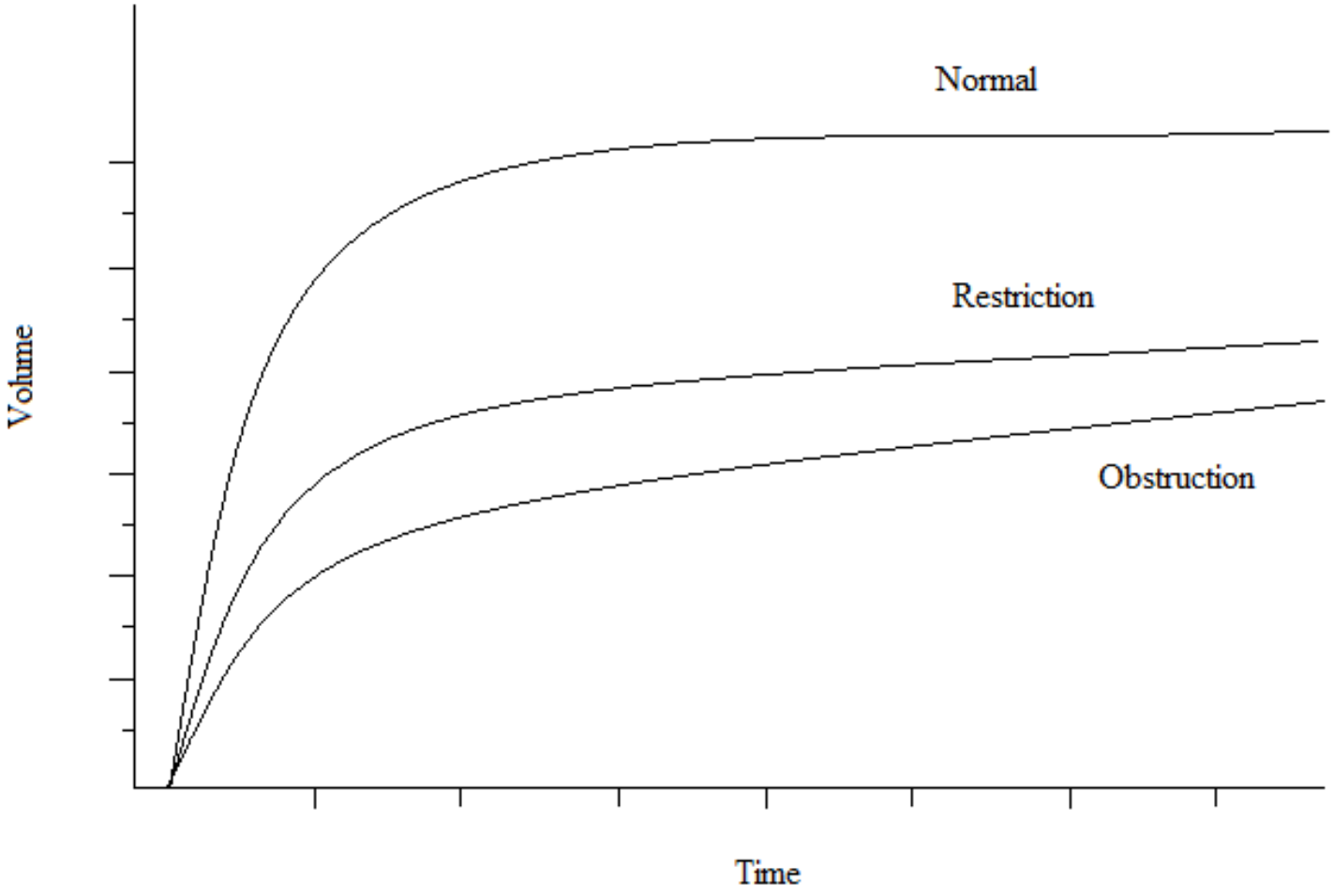
- Males have higher values than females
- Height affects both volume and flow (more height increases both)
- Lung function plateaus at about 25 years of age then start to decline (naturally occurring emphysematous changes)
  - VC decreases at about 30 mL/yr after age 35
- While VC decreases, RV increases leaving TLC about the same
- Spirometery measures all volumes and capacities except RV, FRC, TLC
  - Lung volume tests such as plethysmography or gas analysis is needed to get these measurements
- Easy to perform starting about 6-8 yrs old

Test Validity Requirements

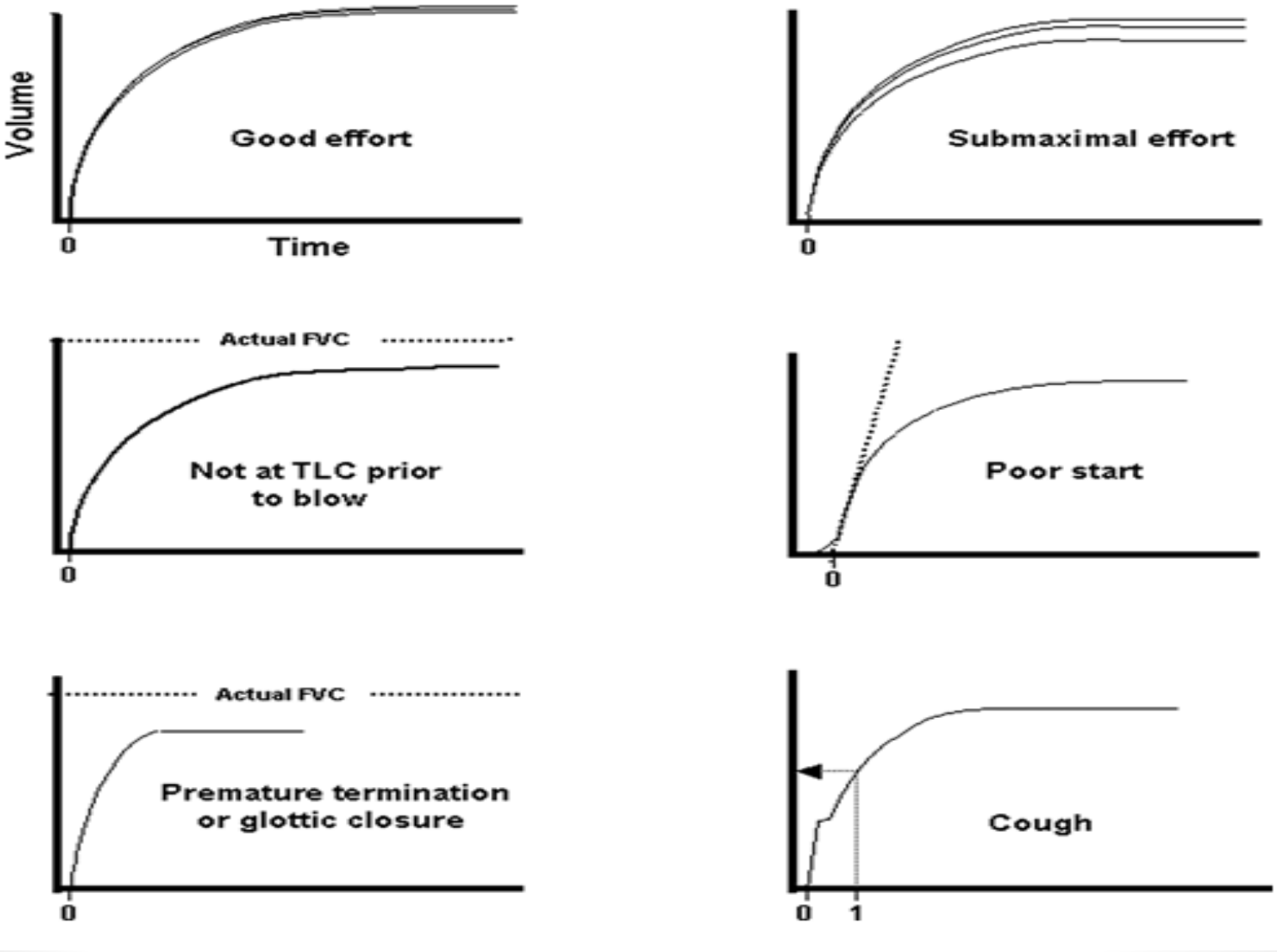
- Good patient technique (Good coaching)
- Patient cooperation (Good coaching)
- Reproducibility (Good coaching)

“Tests should be reproducible and reliable”

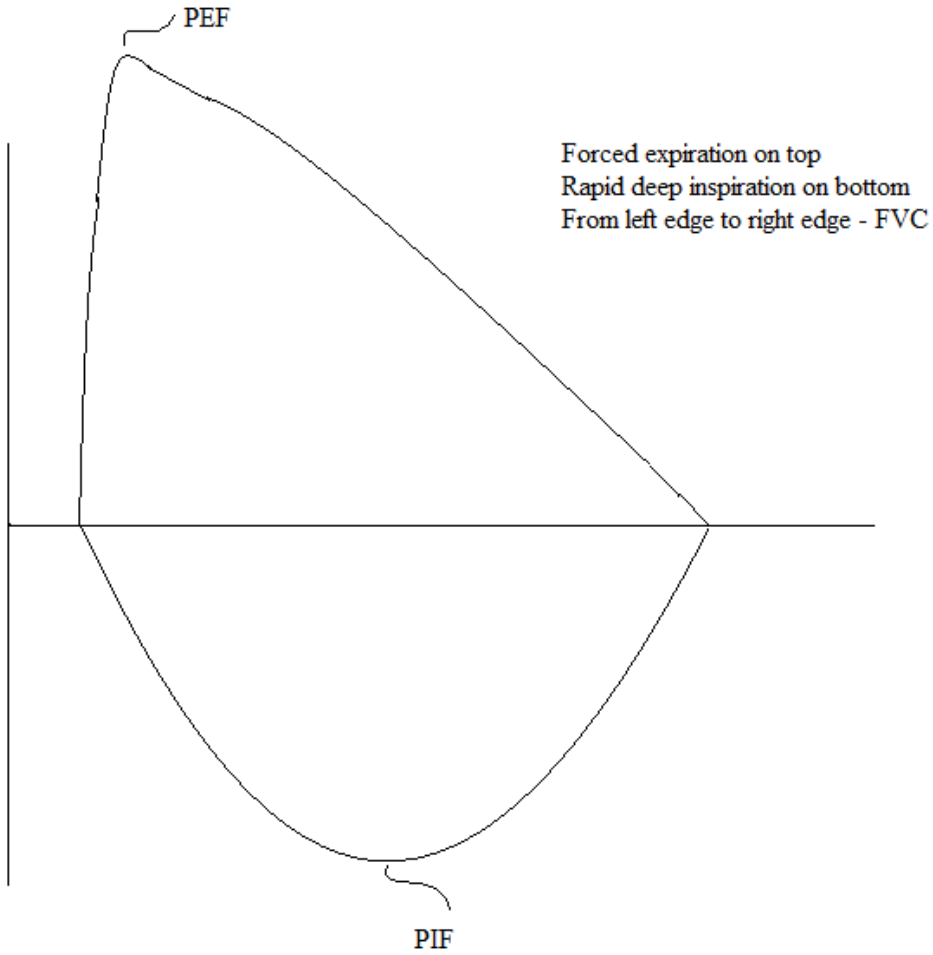
Volume-time curves



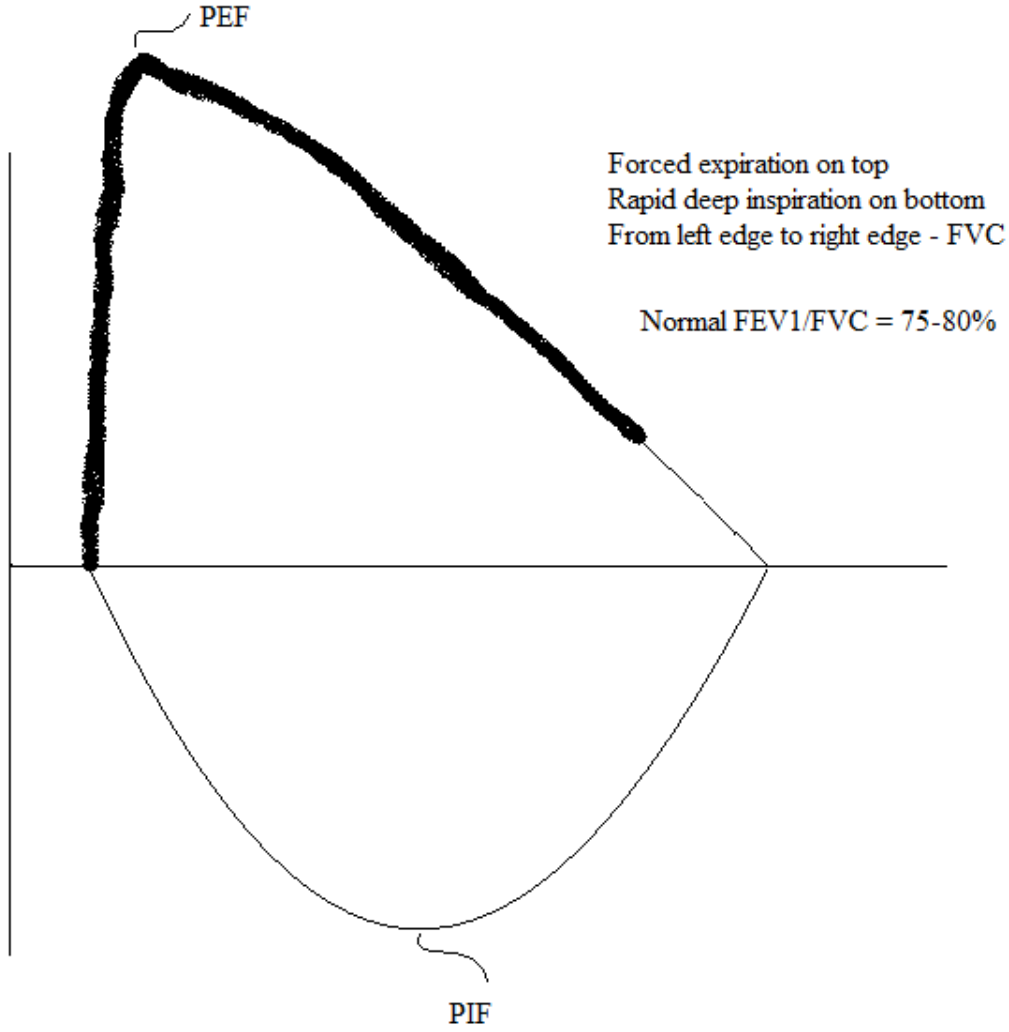
Volume-time curves



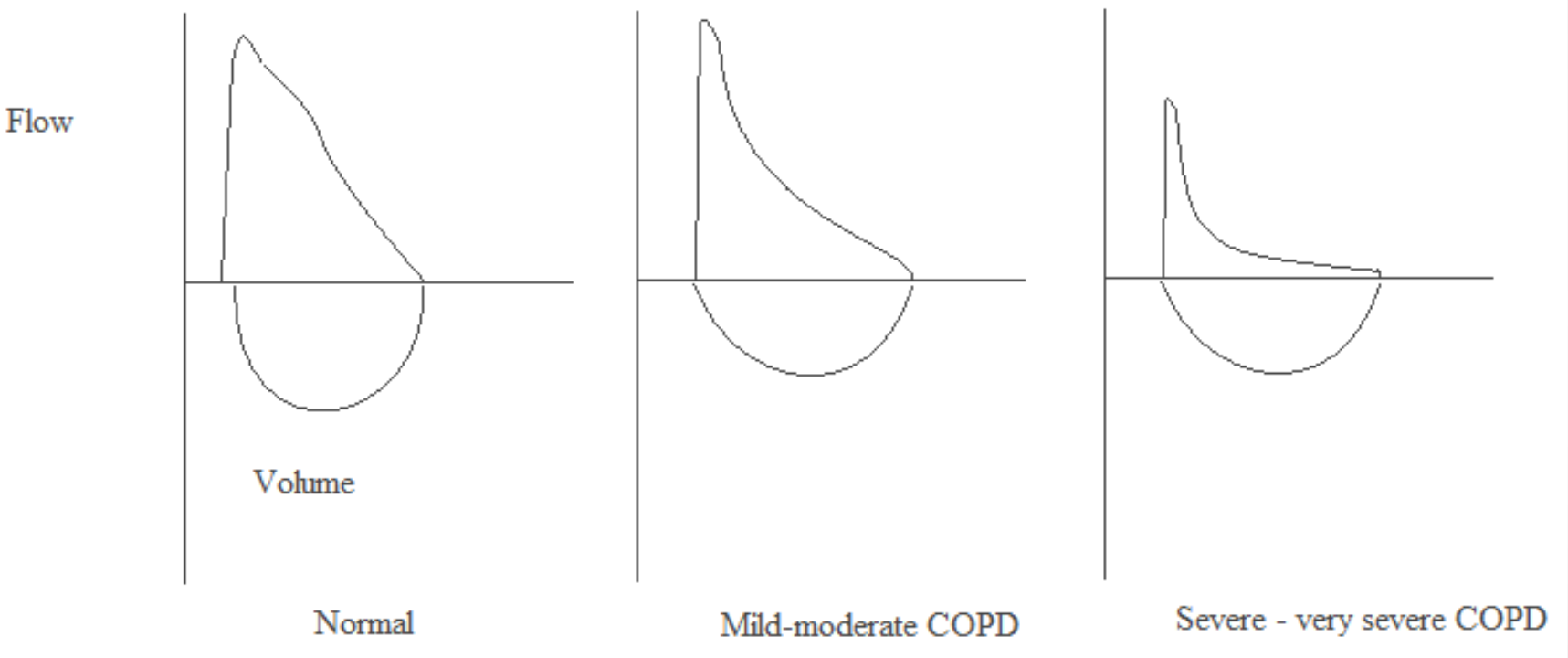
Flow/volume loop



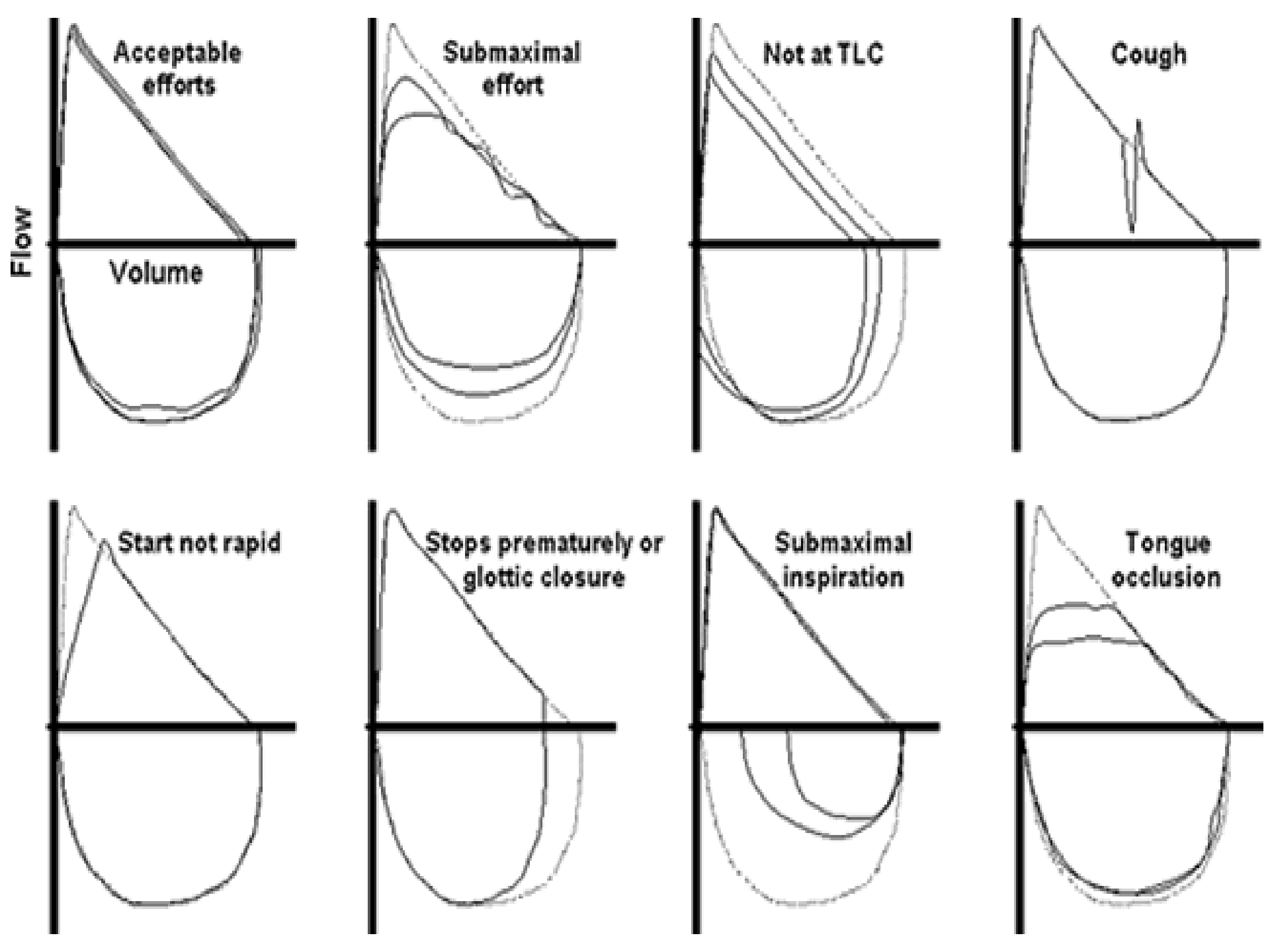
FEV1, PEF, PIF, FVC



Flow/volume loops



Asthma patients may record any of these three F/V loops depending on their status at the time of the recording


Acceptable efforts
Flow
Volume
Submaximal effort
Not at TLC
Cough
Start not rapid
Stops prematurely or glottic closure
Submaximal inspiration
Tongue occlusion

American Thoracic Society (ATS)

- Sets standards for acceptability for equipment
  - Accuracy, calibration, and range of measurement
    - Calibration checks done daily showing $\pm$ 3% accuracy with a 3 L syringe
    - Check calibration using a variety of flow rates
  - Designates equipment to be either for diagnostics or for monitoring
- Volume spirometers must be checked for leaks
- Sets standards for accuracy and reproducibility of tests
- The most recent issues of all the PFT standards can be found at http://www.thoracic.org/statements/

Predicted values

- Comparison of measured to predicted (percent predicted)
  - <80% predicted for single measured values is abnormally low
  - Some are looking to lower limits of normal (LLN) to define abnormality
- Adults – ATS recommends NHANES III for predicted values for those 8 – 80 yrs old
- Pediatrics – ATS recommends Wang for predicted values (subjects <8 yrs old)

R. Pellegrino, G. Viegi, V. Brusasco, et al. Interpretative strategies for lung function tests. Eur Respir J 2005; 26: 948–968

Wang X, Dockery DW, Wypij D, Fay ME, Ferris BG Jr. Pulmonary function between 6 and 18 years of age. Pediatr Pulmonol 1993; 15: 75–88.

Key Determinants of Predicted Values

- Age - values decrease with age
- Height- values increase with height
  - May use arm span (finger tip to finger tip) to estimate height
  - Best option for accurate predicted values is to measure and make sure
- Sex- females have smaller lungs = less volume

- Race/Ethnicity also influences predicted values
  - sometimes called reference values

- Reports given with Measured, Predicted , and Percent predicted. Example:

Example

Value	Meas (L)	Pred (L)	% Pred
FVC	4.71	5.28	89
FEV_1	3.05	3.78	81
FEV_1/FVC	65	- - - -	- - -

Note: Both FVC % predicted and FEV_1% predicted are normal

However - FEV_1ratio is 65 (abnormal)

Other Influencing Factors

- Weight (ideal body weight vs actual weight)
- Environment (ie. air pollution, altitude)
- Smoking

Withholding Medications

Ideally -before performing spirometry, withhold:

- β_2-agonists
  - Short acting β_2-agonists for 4 hours
  - Long acting β_2-agonists for 12 hours

- Anticholinergics
  - Ipratropium for 6 hours
  - Tiotropium for 24 hours

Optimally, subjects should avoid caffeine and cigarette smoking for 30 minutes before performing spirometry

Spirometry Quality Control – 6 points

- Calibrate the spirometer every day – troubleshoot if not acceptable
- At least 3 tests and:
  1. Acceptable tests have no hesitation …BEV < 5% of FVC (start of test)
  2. Acceptable tests have at least 6 seconds for exhalation (middle of test)
  3. Acceptable tests reach a plateau (end of test for recording exhalation)

     <25mL change over 1 second

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  4. The 2 best tests FVC values $\pm$ 150 ml
  5. The 2 best FEV_1 values $\pm$ 150 ml
  6. The best 2 acceptable tests PEF $\pm$ 10%

1, 2, 3 are “within” test criteria; 4, 5, 6 are “between” tests

Quality issues

- Most common cause of inconsistent measurements – poor patient technique
  - Sub-optimal inspiration
  - Sub-maximal expiratory effort
  - Delay in starting forced exhalation
  - Too short expiratory time
  - Air leak around mouthpiece
- Subjects must be observed and encouraged throughout the procedure

Spirometry - Possible Side Effects

- Feeling light-headed
- Headache
- Getting red in the face
- Fainting: reduced venous return or vasovagal attack (reflex)
- Transient urinary incontinence

Spirometry should be avoided after recent heart attack or stroke

Forced Vital Capacity

- Inhale fully then exhale as forcefully as possible for as long as possible to reach end of exhalation (Goal = minimum 6 sec. May go 15+ seconds)

- Directions to subject:
  - “Deep breath in, deeper, deeper, more, more….now BLAST IT OUT and keep blowing!”
  - “Keep blowing , keep blowing , don’t breath in……”

Forced Vital Capacity

- Do at least 3 and usually no more than 8 FVC maneuvers
  - Save all tests for evaluation - pick the best 3 for the report
- Allow patient to rest between maneuvers if needed
- No cough, no leaks, give maximum effort (no “sighs”)

Measurements from FVC

- Forced Vital Capacity (FVC) in liters
- Forced Expiratory Volume in 1 second (FEV_1) liters/sec
- FEV_1 /FVC (aka FEV_1 % or FEV_1 ratio)
  - These 3 are KEY measurements for interpretation and COPD/Asthma guidelines
  - Note: may use FEV_6 instead of FVC

Measurements from FVC

- Forced Expiratory Flow between 200 and 1200 ml
  ($FEF_{200-1200}$) expressed in L/sec
  - Early in exhalation….reflects larger airways
- Forced Expiratory Flow between 25% and 75% of vital capacity
  ($FEF_{25-75\%}$) expressed in L/sec
  - Later in exhalation… reflects medium to small airways
- Peak Flow (PEFR, PEF, PF) expressed in L/sec
- Forced expiratory time (length of time for exhalation)
  - $FET_{100\%}$

FVC
(Forced Vital Capacity)

- May be recorded in a volume/time curve or flow/volume loop
- PFTs are measured at ATPS but must be reported at BTPS.
    - Ambient temperature, pressure, saturated
    - Body temperature, pressure, saturated

Spirometry Interpretation: Obstructive vs. Restrictive Defect

- *Obstructive Disorders*
  - Limitation of expiratory airflow so that airways cannot empty as rapidly compared to normal (such as through narrowed airways from bronchospasm, inflammation, etc.)

  Examples:
  - Asthma
  - COPD (Emphysema –Chronic bronchitis)
  - Cystic Fibrosis

- *Restrictive Disorders*
  - Reduced lung volumes and often decreased lung compliance

  Examples*:*
  - Interstitial Fibrosis
  - Scoliosis
  - Obesity
  - Lung Resection
  - Neuromuscular diseases
  - Cystic Fibrosis

Spirometry Interpretation: Obstructive vs. Restrictive Defect

- *Obstructive Disorders**
  - FVC nl or↓
  - FEV1 ↓
  - FEF25-75% ↓
  - FEV1/FVC ↓
  - TLC nl or ↑
- *Restrictive Disorders***
  - FVC ↓
  - FEV1 ↓
  - FEF 25-75% nl to ↓
  - FEV1/FVC nl to ↑
  - TLC ↓

* COPD defined by the FEV1/FVC (<70% in GOLD guidelines)

** Restriction is a possible issue using these criteria if there is no obstruction and FVC< 80% predicted

Before and After Bronchodilator Therapy (Pre & post bronchodilator)

- To be called "Significant response to bronchodilator"
  - (+) 12% change and 200 cc increase in FEV_1
  - This is the most "favored" change*

……OR ……

  - (+) 12% change and 200 cc increase in FVC

- % Change =[Post - Pre) / Pre] * 100
  - Expectation is for increased FVC and FEV_1 post tx
    - Note: Decreased volume (FVC) in post measurements could be related to fatigue

- Asthma patients often show significant response (reversible AFO). COPD patients show positive response but not significant unless they have overlap syndrome

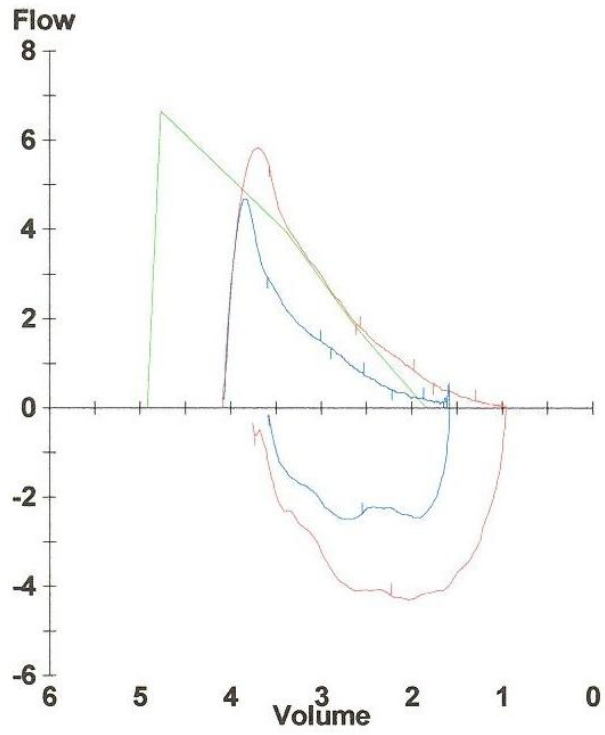
Before and After Bronchodilator Therapy (Pre & post bronchodilator)

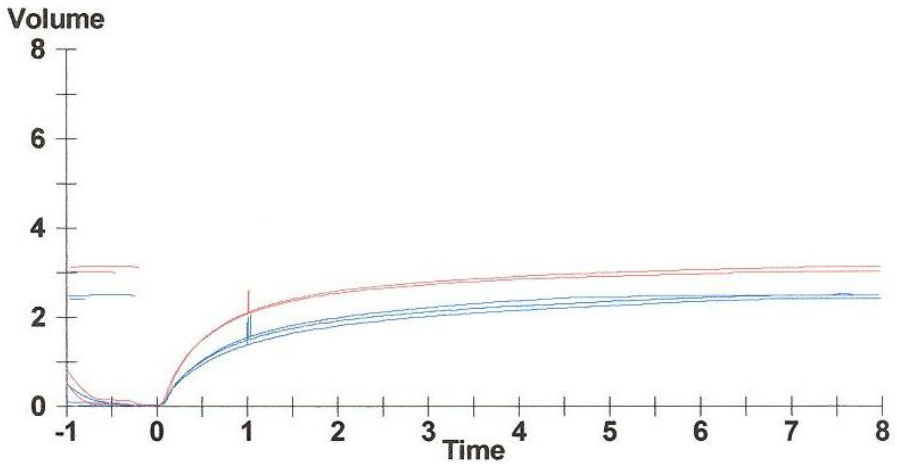
- Indication: FEV_1 ratio is less than predicted
- Patient should hold meds that could "blunt" the spirometry
  - Hold quick-acting bronchodilators at least 4 hours prior to testing (if possible), long lasting at least 12 hours
- Record baseline (pre) F/V loops and lung volumes (lung subdivisions) before giving bronchodilator (if doing a complete PFT)
- Give tx and wait 15 minutes before retesting F/V loops

This photo courtesy of the American Association for Respiratory Care

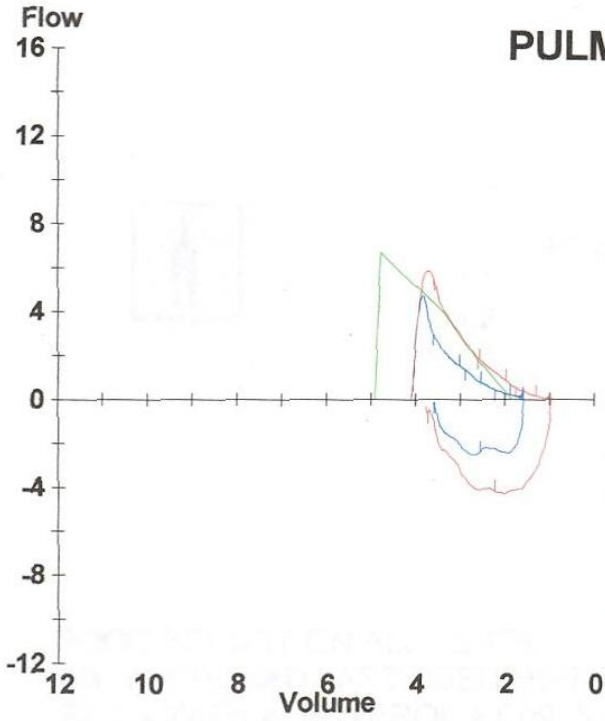
This photo courtesy of my boss

Pre-post F/V loops and V/T curves





Pre/post measurement



PULMONARY FUNCTION ANALYSIS

Spirometry

		Ref	Pre Meas	Pre % Ref	Post Meas	Post % Ref	Post % Chg
FVC	Liters	3.08	2.52	82	3.14	102	25
FEV1	Liters	2.61	(1.59)	(61)	2.14	82	35
FEV1/FVC	%	85	(63)		(68)		
FEF25-75%	L/sec	3.06	(0.87)	(28)	(1.32)	(43)	52
FEF200-1200	L/sec	5.45	(1.97)	(36)	3.97	73	101
PEF	L/sec	6.65	(4.69)	(70)	5.84	88	25
FET100%	Sec		7.64		8.78		15
FIVC	Liters	3.63	(2.01)	(56)	2.80	77	39
MVV	L/min	113	(46)	(41)			
f	BPM		75				

Asthma COPD Overlap Syndrome (ACOS)

- Compared to asthma or COPD alone, these patients have
  - More frequent exacerbations
  - Lower quality of life
  - More rapid decline in lung function
  - Higher mortality
  - Consume a disproportionate amount of healthcare resources

- Concurrent doctor-diagnosed asthma and COPD has been reported in between 15 and 20% of patients
  - If the differential diagnosis equally balanced between asthma and COPD (i.e. ACOS) the default position should be to start treatment accordingly for asthma

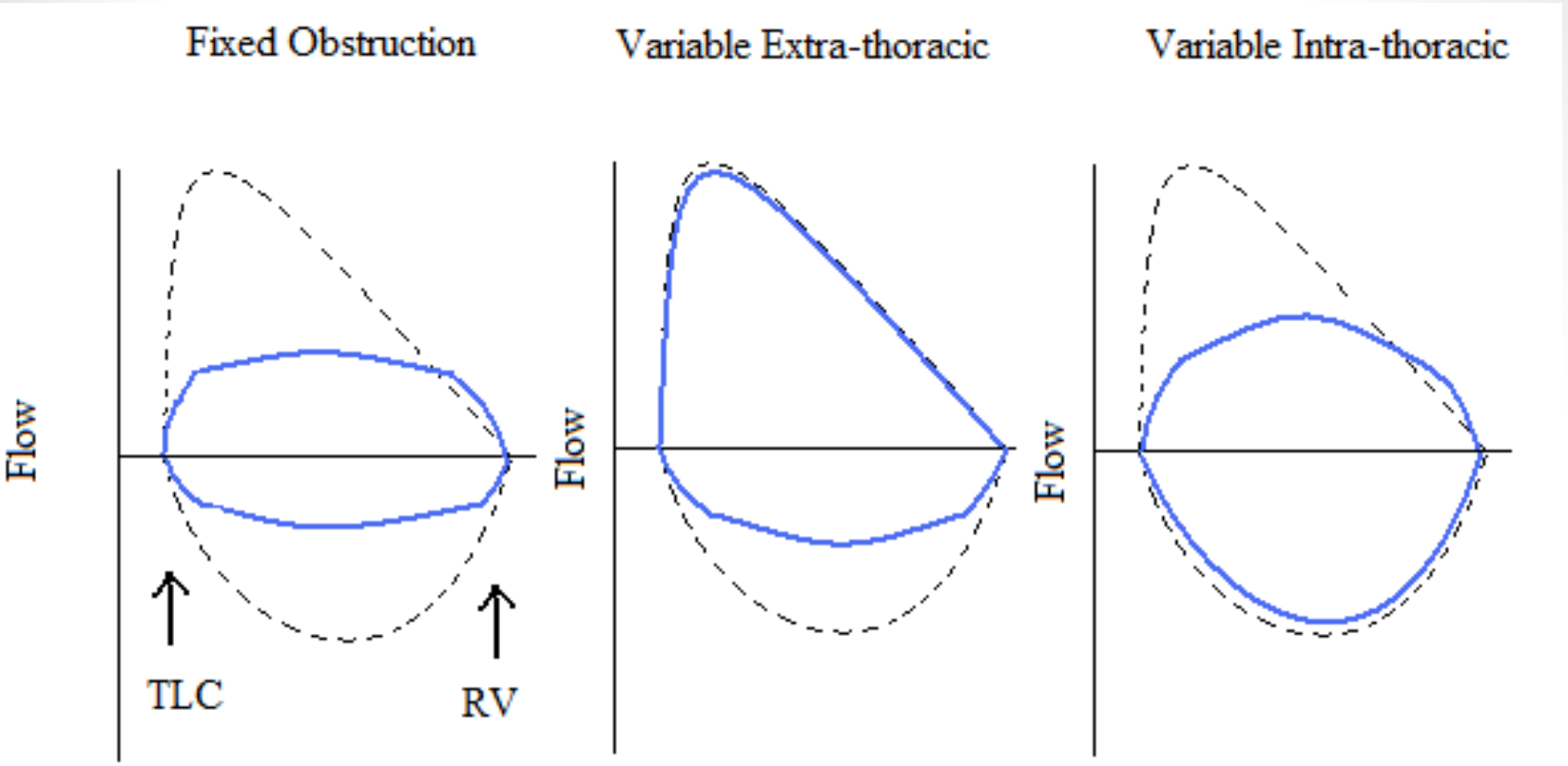
Diagnosis of Diseases of Chronic Airflow Limitation: Asthma, COPD and Asthma-COPD Overlap Syndrome (ACOS) 2014

Overlap syndrome (ACOS)

Spirometry variable	Asthma	COPD	ACOS
Post-BD increase in FEV_1 >12% and 200 ml (reversibility)	Usual at some time with asthma, but may not be present when well controlled or on controllers	Common and more likely when FEV1 is low, but ACOS should also be considered	Common and more likely when FEV1 is low, but ACOS should also be considered
Post-BD increase in FEV_1 >12% and 400 ml (marked reversibility)	High probability of asthma	Unusual in COPD. Consider ACOS	Compatible with diagnosis of ACOS

Central and upper airway obstruction

- Fixed Obstruction
  - Foreign bodies/tumors
  - Scarring/stiffening of upper airways
- Variable Extra-thoracic
  - Tumors
  - Weak pharyngeal muscles
  - Tracheomalacia
  - Paralyzed vocal chords
  - Enlarged lymph nodes
  - Inflammation
- Variable Intra-thoracic
  - Tumors
  - Mediastinal adenopathy



Fixed Obstruction

Foreign bodies/tumors
Scarring/stiffening of upper airways

Both loops are affected (I & E)

Variable Extra-thoracic

Tumors
Weak pharyngeal muscles
Tracheomalacia
Paralyzed vocal chords
Enlarged lymph nodes
Inflammation

Affects the inspiratory loop

Variable Intra-thoracic

Tumors
Mediastinal adenopathy

Affects the expiratory loop

When interpreting…..

- Review the demographics
  - Age, height, gender, race, weight
- Check the symptoms
  - Cough (dry?), SOB, wheezing, chest tightness
  - Any patterns? Seasonal, occupational?
- When was the last time they had a SABA? LABA? ICS?
- Look over the history and chief complaint
  - Smoker? Pack yrs? Include pipe, cigar, waterpipe (hookah)
  - Comorbidities?

Co-morbidities: COPD and asthma (in adults)

- Ischemic heart disease (CAD), hypertension, CHF, pulmonary hypertension, M.I., stroke
- Lung cancer
- Restrictive lung diseases (asbestosis, sarcoidosis)
- Pulmonary embolism
- Pneumonia, CF, bronchiectasis
- DM, obesity, OSA, malnutrition, GERD
- Dementia, Alzheimer's, depression
- Neuromuscular diseases
- Osteoporosis, arthritis, gout, hearing loss, vision loss

When interpreting

- Read the comments made by the person coaching the test
  - “C/O chest pain”
  - “Frequent coughing”
  - “Unable to perform test, unable to follow instructions”
- Look at the graphs
- Study the numbers and check against the predicted values
- <80 % predicted or <LLN to define abnormalities

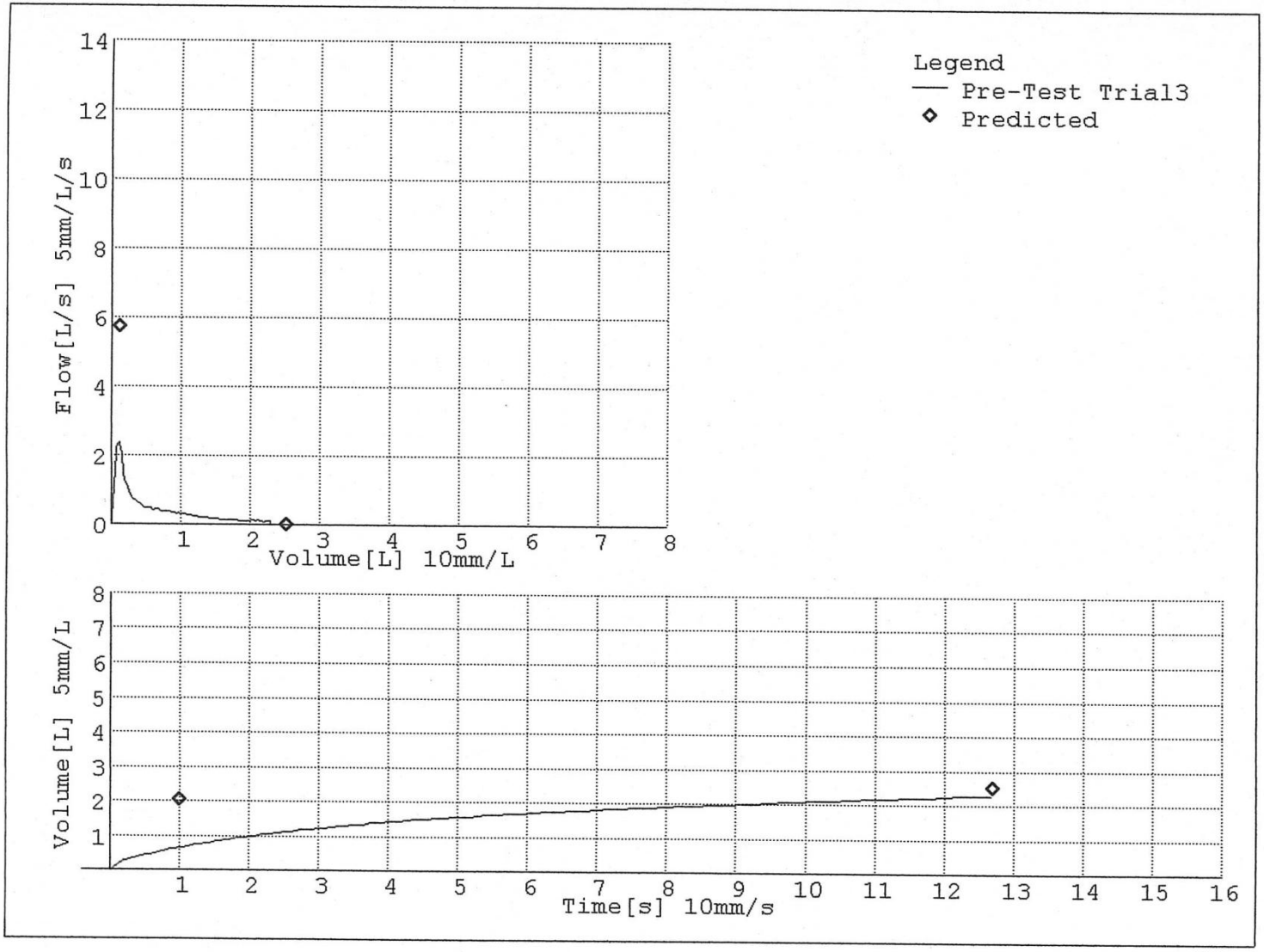
Differential diagnosis of asthma

- COPD
- Congestive heart failure
- Pulmonary embolism
- Upper Airway Cough (UAC)
- GERD
- Vocal cord dysfunction
- Cystic fibrosis
- Pulmonary infiltration with eosinophilia
- Cough secondary to drugs (i.e., ACE inhibiters)
- Allergic bronchopulmonary aspergillosis
- Churg-Strauss syndrome
- Malignancy obstruction of the airways

Teaching Case 8

- 46 year old female: 5’0”, 116 lbs. Vital signs- early HTN
- Says she has been told she has asthma (dx at16)
  - Prod cough 5-6 days a week, more in AM
  - Daily wheezing, has chest tightness 6-7 days a week, more at night
  - Sleep: c/o cough, wheeze at night ~ 5-6 times a week
  - DOE
  - Faint bilateral I&E wheezes
  - Has GERD
- 30 pk/yrs smoking. Quit 2 months ago. Recent hospital admt for pneumonia
- Allergies: NKDA. Triggers: pollen, dust, dogs, cleaning products
- Occupational: works as a housekeeper at hotel
- Family: Father, sister, 2 granddaughters have asthma
- Using albuterol 2 inh PRN plus nebulizer (several times each day). Zyrtec (cetirizine)as needed during pollen seasons
- Last used albuterol at 1 AM (9 hrs prior to testing)

Teaching case 8



Teaching case 8

Patient Information

Name	Teaching case 8
ID	
Age	46
Height	5 ft 0 in
Weight	130 lbs, BMI 25.5
Gender	FEMALE
Ethnic	AFRICAN
Smoker	FORMER
Asthma	YES

Test Information

Test Date/Time	10:43am
Post Time	--:--
Test Mode	DIAGNOSTIC
Interpretation	NLHEP
Predicted Ref	NHANES III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

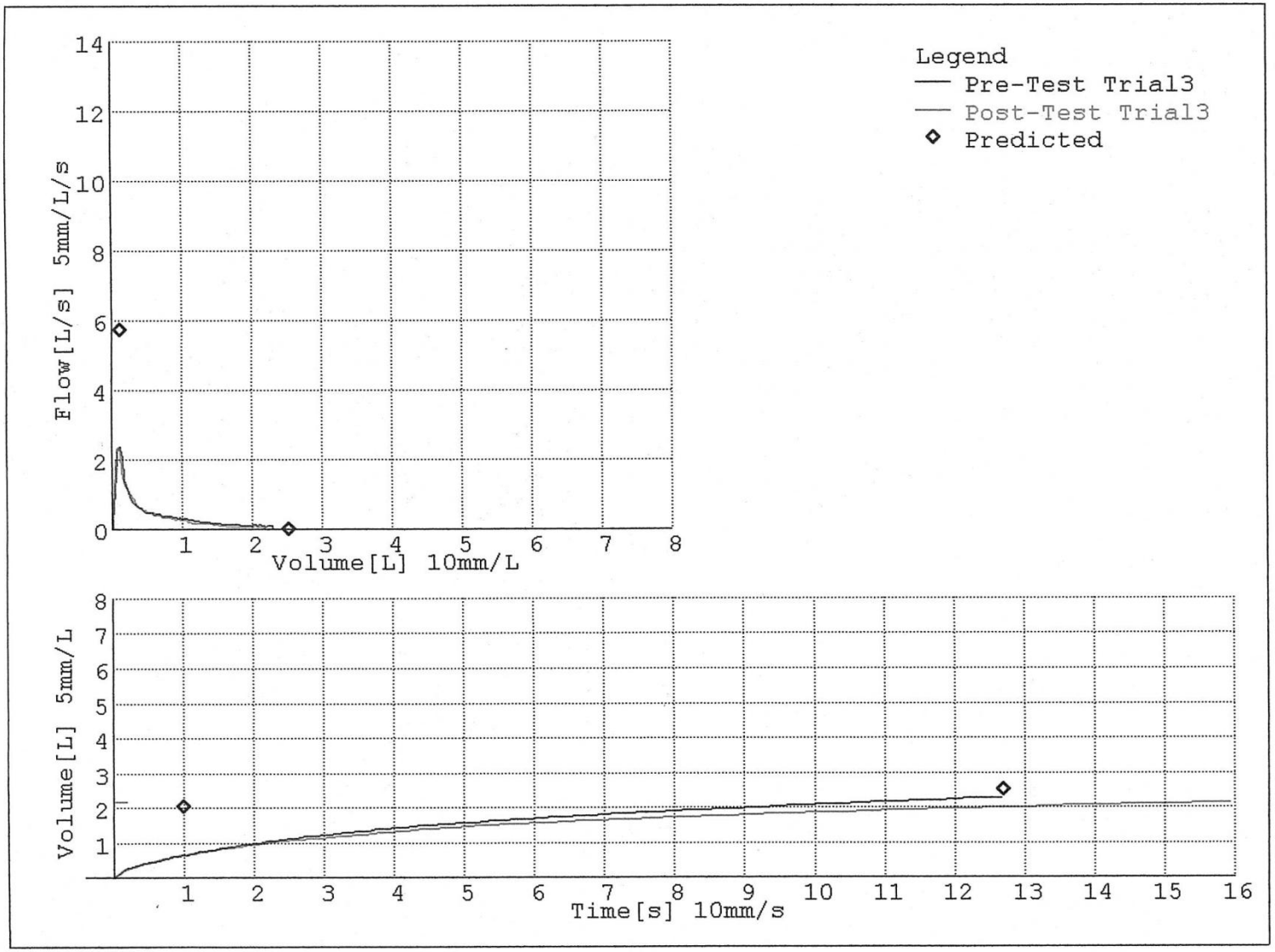
Test Results Your FEV1 is 32% Predicted

	Pre-Test					
Parameter	Best	Trial3	Trial2	Trial1	Pred	%Pred
FVC[L]	2.29	2.29	2.25	2.14	2.52	91
FEV1[L]	0.66*	0.66*	0.59*	0.60*	2.05	32
FEV1/FVC	0.29*	0.29*	0.26*	0.28*	0.82	35
FEF25-75[L/s]	0.21*	0.21*	0.18*	0.19*	2.32	9
FET[s]	12.70	12.70	14.79	14.24	-.--	--

* Indicates Below LLN or Significant Post Change

Pre-Test Interpretation	FEV1 Var=0.07L 10.4%; Severe Obstruction	FVC Var=0.04L 1.8%;	Session Quality A

Teaching case 8



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Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Test Results Your FEV1 is 32% Predicted

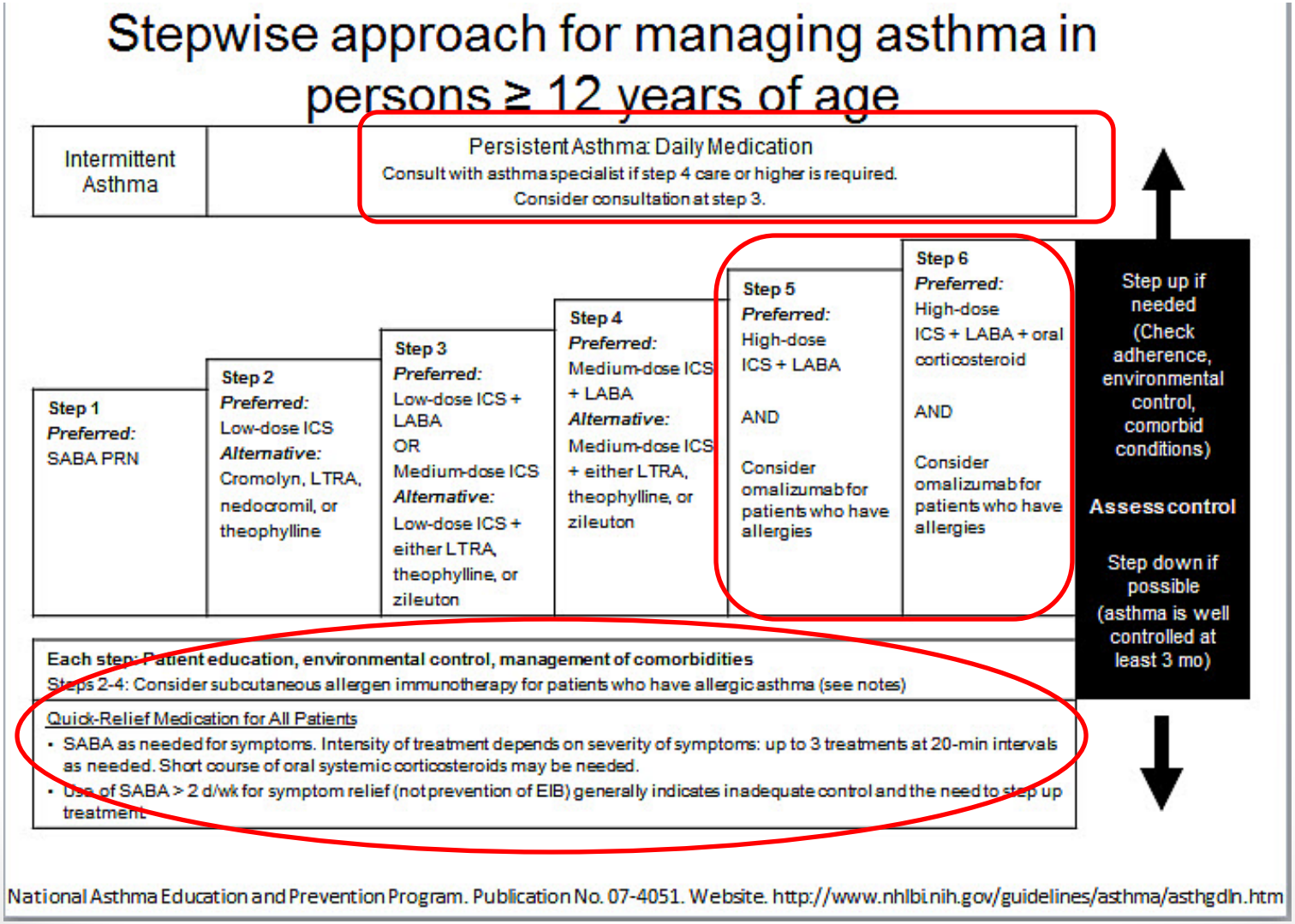
	Pre-Test						Post-Test				
Parameter	Best	Trial3	Trial2	Trial1	Pred	%Pred	Best	Trial3	Trial1	Trial2	Chg
FVC[L]	2.29	2.29	2.25	2.14	2.52	91	2.17	2.17	2.14	2.07	-5%
FEV1[L]	0.66*	0.66*	0.59*	0.60*	2.05	32	0.69*	0.67*	0.69*	0.66*	3%
FEV1/FVC	0.29*	0.29*	0.26*	0.28*	0.82	35	0.32*	0.31*	0.32*	0.32*	
FEF25-75[L/s]	0.21*	0.21*	0.18*	0.19*	2.32	9	0.18*	0.18*	0.23*	0.19*	-14%*
FET[s]	12.70	12.70	14.79	14.24	-.--	--	16.22	16.22	14.10	14.36	

* Indicates Below LLN or Significant Post Change

Pre-Test	FEV1 Var=0.07L 10.4%;	FVC Var=0.04L 1.8%;	Session Quality A
Post-Test	FEV1 Var=0.02L 2.5%;	FVC Var=0.03L 1.2%;	Session Quality A
Interpretation	Severe Obstruction		

Case 8 – plan of care

- Severe persistent asthma, probably Overlap Syndrome



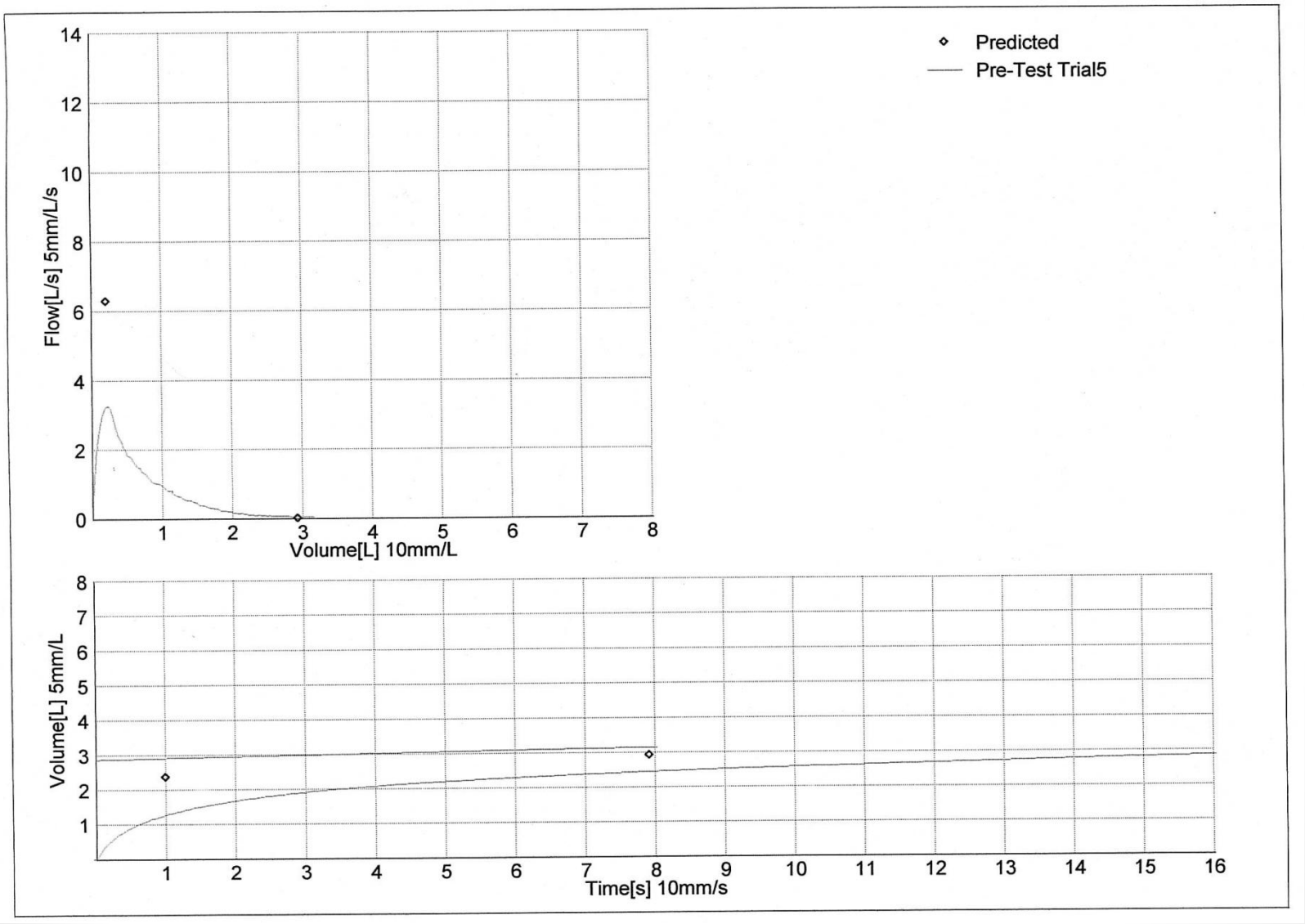
Case 8 Plan of care

- SABA: Albuterol 2 inhalations PRN QID
- LABA/ICS high dose : Fluticasone/Salmeterol (500/50) 1 inh BID (check for adequate inspiratory flow – DPI or MDI?)
- Control GERD –proton pump inhibitor (esomeprazole or omeprazole)
- LTRA: Montelucast 10 mg PO daily
- Start drug assistance program to get meds on regular basis
- Confirm proper technique with all inhaler devices
- Avoid triggers and continue to stop smoking
- Get influenza vaccination each fall
- Get pneumococcal vaccination
- Provide Asthma Action Plan – cover exacerbations
- Discuss diet and exercise (weight loss?)
- Follow-up visit in 2 weeks

Teaching Case 2

- 47 year old female: 5’4”, 141 lbs. Vital signs normal
- Says she has been told she has asthma
  - Daily prod cough, more at night and in the AM
  - No c/o wheezing, has chest tightness 3-4 days a week
  - Sleep: c/o some cough at night ~ 3-4 times a week
  - DOE
  - Faint bilateral wheezes
  - No c/o GERD
- Never smoked, No hospital or ED visits, No loss of usual activities
- Allergies: NKDA. Triggers: pollen, cigarette smoke, cleaning products
- Occupational: c/o propane-powered floor cleaner at the grocery where she works
- Family: negative for asthma
- Using albuterol 2 inh PRN plus nebulizer (several times each day). Tried Advair for about 2 weeks and quit - made face swell
- Last used albuterol at 3 AM (7 hrs prior to testing)

Case 2 Female, 47 y/o, 5'4", 141 lbs



Case 2 Female, 47 y/o, 5'4", 141 lbs

Patient Information

Name	Teaching case 2
ID	
Age	47
Height	5 ft 4 in
Weight	141 lbs,BMI 24.4
Gender	FEMALE
Ethnic	AFRICAN
Smoker	NO
Asthma	YES

Test Information

Test Date/Time	11:01am
Post Time	--:--
Test Mode	DIAGNOSTIC
Syst. Interpret.	NLHEP
Predicted Ref	Nhanes III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

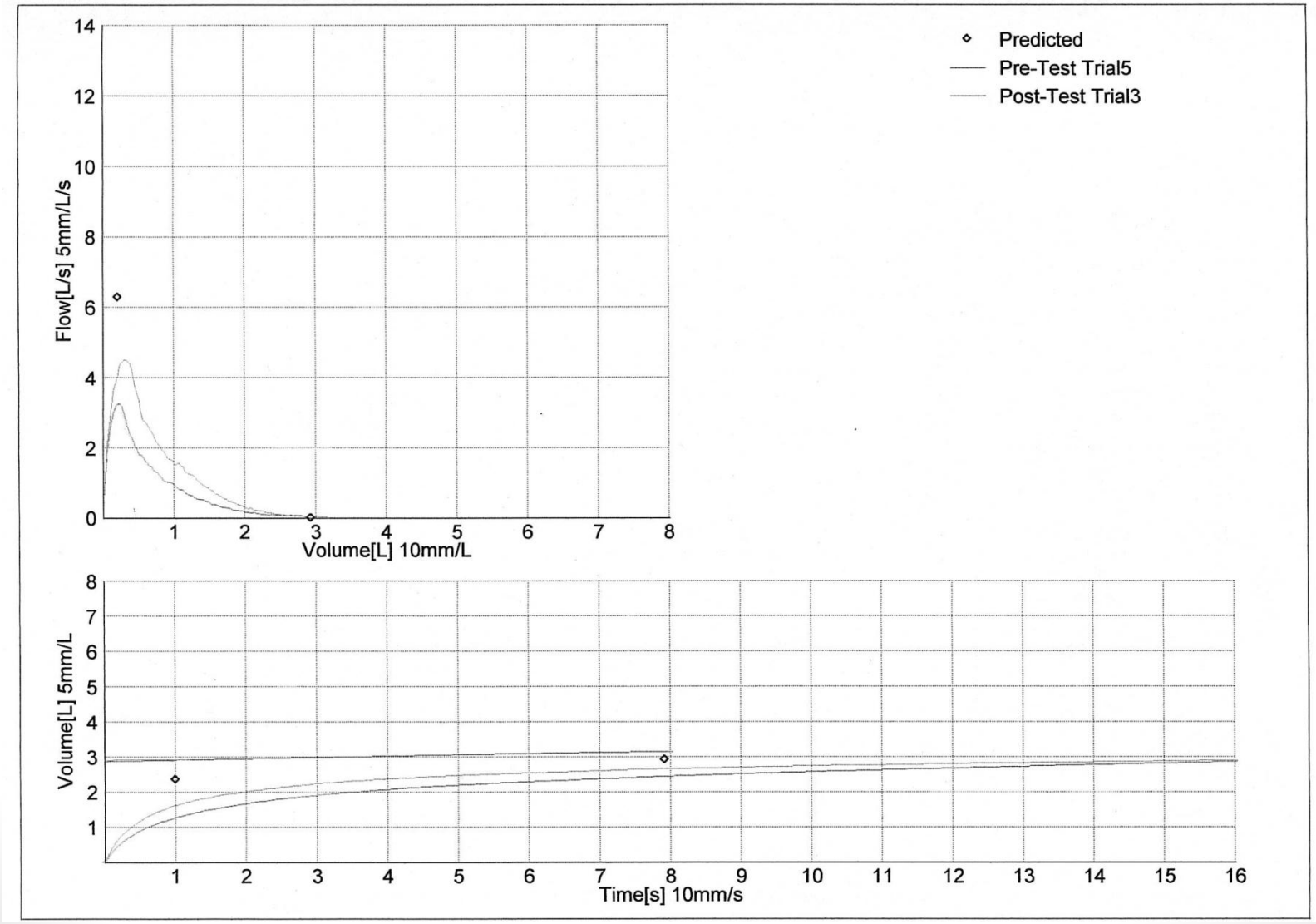
FVC Test Results **Your FEV1 is 55% Predicted**

Parameter	Best	Trial5	Trial3	Trial4	Pred	%Pred
FVC[L]	3.15	3.15	3.02	2.84	2.93	108
FEV1[L]	1.30*	1.28*	1.24*	1.30*	2.37	55
FEV1/FVC[%]	41.1*	40.7*	41.2*	45.7*	82.0	50
PEF[L/s]	3.28*	3.28*	3.05*	2.83*	6.30	52
FEF25-75[L/s]	0.25*	0.25*	0.21*	0.28*	2.55	10
FET[s]	23.92	23.92	23.75	19.30	-.--	--

* Indicates Below LLN

Pre-Test	FEV1 Var=0.01L 0.9%;FVC Var=0.13L 4.3%;Session Quality B
Syst. Interpret.	Moderate Obstruction

Case 2 Female, 47 y/o, 5'4", 141 lbs



Case 2 Female, 47 y/o, 5'4", 141 lbs

Patient Information

Name	Teaching case 2
ID	
Age	47
Height	5 ft 4 in
Weight	141 lbs,BMI 24.4
Gender	FEMALE
Ethnic	AFRICAN
Smoker	NO
Asthma	YES

Test Information

Test Date/Time	
Post Time	11:47am
Test Mode	DIAGNOSTIC
Syst. Interpret.	NLHEP
Predicted Ref	Nhanes III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

FVC Test Results **Your FEV1 is 55% Predicted (Post-Test FEV1 69% Predicted)**

	Pre-Test						Post-Test				
Parameter	**Best**	**Trial5**	**Trial3**	**Trial4**	**Pred**	**%Pred**	**Best**	**Trial3**	**Trial2**	**Trial1**	**Chg**
FVC[L]	3.15	3.15	3.02	2.84	2.93	108	2.94	2.94	2.82	2.73	-7%
FEV1[L]	**1.30***	**1.28***	**1.24***	**1.30***	2.37	55	**1.63***	**1.63***	**1.55***	**1.52***	**26%***
FEV1/FVC[%]	**41.1***	**40.7***	**41.2***	**45.7***	82.0	50	**55.6***	**55.6***	**54.8***	**55.5***	
PEF[L/s]	**3.28***	**3.28***	**3.05***	**2.83***	6.30	52	4.51	4.51	**4.27***	**4.03***	**38%***
FEF25-75[L/s]	**0.25***	**0.25***	**0.21***	**0.28***	2.55	10	**0.58***	**0.58***	**0.47***	**0.53***	**134%***
FET[s]	23.92	23.92	23.75	19.30	-.--	--	17.23	17.23	17.35	15.66	

*** Indicates Below LLN or Significant Post Change**

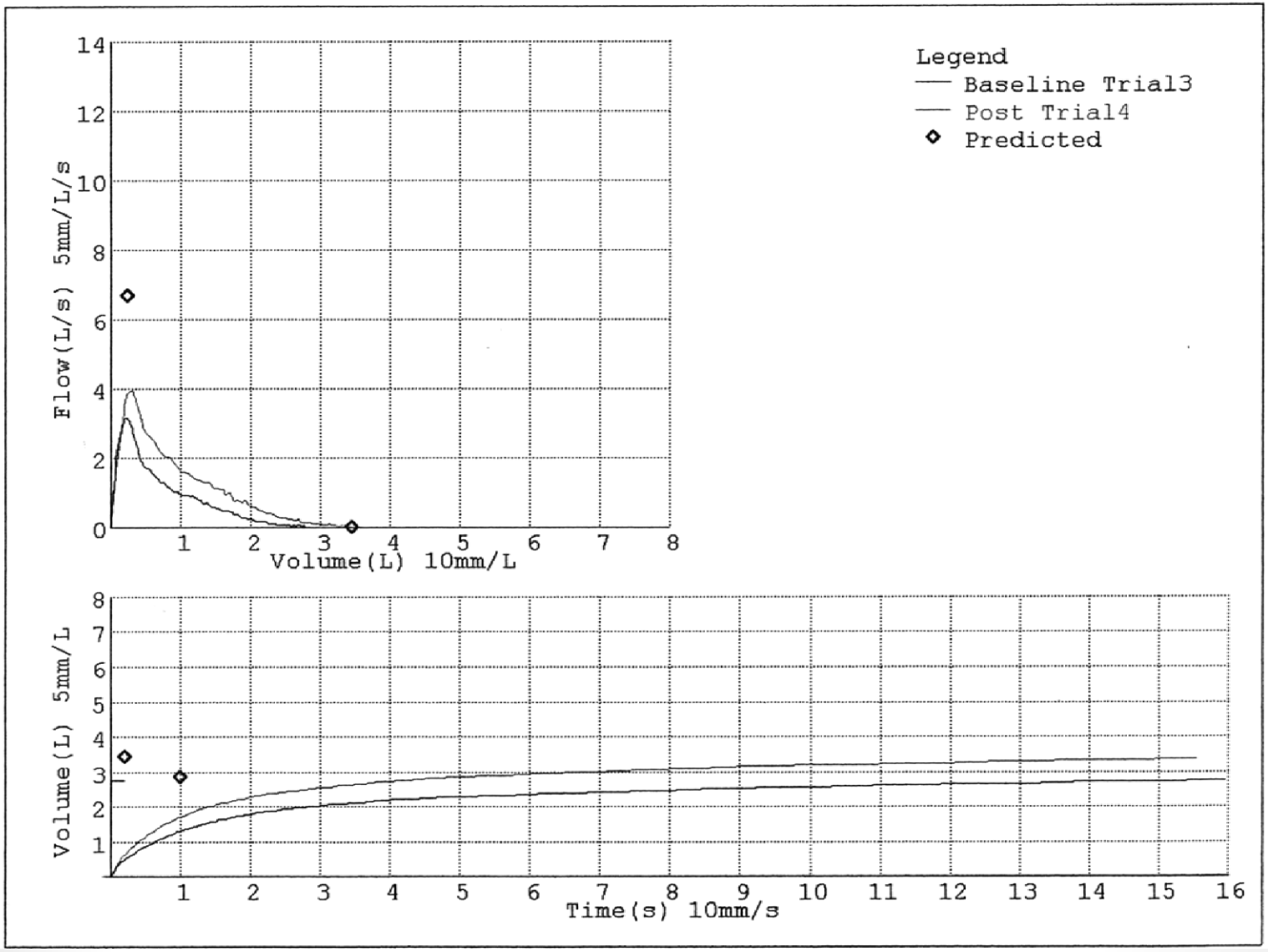
Pre-Test	FEV1 Var=0.01L 0.9%;FVC Var=0.13L 4.3%;Session Quality B
Post-Test	FEV1 Var=0.09L 5.3%;FVC Var=0.12L 3.9%;Session Quality B
Syst. Interpret.	Moderate Obstruction

FET -38.82% drop but missed only 210 mL in FVC

Teaching case 1

- 38 year old female: 5’2”, 119 lbs. Vital signs normal
  - No c/o cough or chest tightness
  - Wheezing 2-3 days/wk, more at night
  - Sleep: c/o some SOB at night
  - SOB occasionally with exertion (DOE)
  - Faint wheezes
- Smoked for a few months and quit
- No hospital or ED visits
- No loss of usual activities
- Allergies: NKDA but c/o sinus issues. Triggers: dog, dust
- Family: hx of asthma
- Using albuterol 2 inh PRN (used once a day for last several days

Case 1 Female, 38 y/o, 5'2", 119 lbs (Pre/Post)



Case 1 Female, 38 y/o, 5'2", 119 lbs (Pre/Post)

Patient Information

Name	Teaching case 1
ID	
Age	38
Height	5 ft 2 in
Weight	119 lbs, BMI 21.9
Gender	FEMALE
Ethnic	CAUCASIAN
Smoker	FORMER
Asthma	POSSIBLE

Test Information

Test Date	09:40am
Post Time	10:09am
Test Mode	DIAGNOSTIC
Interpretation	NLHEP
Predicted Ref	NHANES III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Test Results Your FEV1 is 46% Predicted

	Baseline						Post				
Parameter	Best	Trial3	Trial2	Trial1	Pred	%Pred	Best	Trial4	Trial3	Trial1	Chg
FVC(L)	2.78*	2.78*	2.70*	2.47*	3.45	80	3.38	3.38	3.33	3.12	22%*
FEV1(L)	1.32*	1.32*	1.31*	1.20*	2.85	46	1.73*	1.73*	1.70*	1.60*	31%*
FEV1/FVC	0.48*	0.48*	0.49*	0.49*	0.83	58	0.51*	0.51*	0.51*	0.51*	
PEF(L/min)	188*	188*	179*	173*	400	47	235*	235*	224*	202*	25%*
FEF25-75(L/s)	0.48*	0.48*	0.47*	0.48*	3.08	16	0.65*	0.65*	0.66*	0.66*	36%*
FET(s)	16.21	16.21	16.15	10.74	-.--	--	15.57	15.57	15.62	13.18	

* Indicates Below LLN or Significant Post Change

Baseline	FEV1 Var=0.01L 0.8%;	FVC Var=0.08L 2.7%;	Session Quality A
Post	FEV1 Var=0.03L 1.9%;	FVC Var=0.04L 1.3%;	Session Quality A
Interpretation	Moderate Obstruction and Low vital Capacity possibly due to restriction		

FET Dropped ~4% but got 600 mL more in FVC

Conclusion

- Spirometry can provide an objective measurement of lung function and provide clues to discern several conditions (asthma, COPD, restrictive disorders)
- It takes trained personnel to be done properly and to troubleshoot issues for quality
- It can be done with very little capital invested but provides excellent tracking for pulmonary issues (billable procedure)

- Resources:
- AARC Clinical practice guidelines www.rcjournal.com/cpgs/index.cfm
- For COPD - www.goldcopd.com
- For Asthma - www.nhlbi.nih.gov/guidelines/asthma
- For Certified Asthma Educator credential (AE-C) - www.naecb.com

Thank you for listening

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